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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09 821,554	03 29 2001	Weng Chang	67,200-367	5869

7590 08 07 2002

TUNG & ASSOCIATES
838 W. Long Lake Road, Suite 120
Bloomfield Hills, MI 48302

EXAMINER

UMEZ, ERONINI, LYNETTE T

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 08 07 2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/821,554

Applicant(s)

CHANG ET AL.

Examiner

Lynette T. Umez-Eronini

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.

- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s)

- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu et al. (US 6,004,883) in view of Hopper et al. (US 6,030,901) and Avanzino et al. (US 5,691,238)

Yu teaches a method of forming an aperture through a dielectric layer. The method comprises:

" . . . there is first provided a substrate within a microelectronic fabrication" (column 4, lines 15-16 and column 6, lines 49-53);

"There is then formed upon the substrate a patterned first dielectric layer which defines a via accessing a contact region" (column 4, lines 16-19), which reads on, forming upon the substrate a patterned first dielectric layer formed of a first dielectric material, the patterned first dielectric layer defining a via;

"The patterned first dielectric is then formed from a first dielectric material . . ." and "There is then formed upon the patterned first dielectric layer a blanket second dielectric layer, where the blanket second dielectric layer completely covers the

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forming upon the patterned first dielectric layer and filling the via a blanket second dielectric material;

"The blanket second dielectric layer is formed of a second dielectric material . . ."

"There is then formed upon the blanket second dielectric layer a blanket hard mask layer, where the blanket is formed from a hard mask material . . ." and "There is then formed upon the blanket hard mask layer a patterned photoresist layer, where the patterned photoresist layer leaves exposed a portion of the blanket hard mask layer greater than an areal dimension of the via and at least partially overlapping the areal dimension of the via" (column 4, lines 26-37), which read on, forming over the blanket second dielectric layer a patterned mask layer which defines the location of a trench to be formed through the blanket second dielectric layer, where an areal dimension of the trench is greater than at least in part overlapping an areal dimension of the via;

"There is then etched while employing a first plasma etch method the blanket hard mask layer to form a patterned hard mask layer defining a first trench formed through the patterned hard mask layer while employing the patterned photoresist layer as a first etch mask layer" (column 4, lines 37-42) and "The aperture comprises: (1) a second trench corresponding with the first trench; and (2) at least a portion of the first via" (column 4, lines 48-50), which reads on etching, while employing the patterned mask layer, and the blanket second dielectric layer to form an aperture comprising: the trench; and at least a portion of the via, where the patterned first dielectric layer provides an intrinsic etch stop

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Yu differs in failing to teach a first dielectric layer having a dielectric constant of less than 4.0 and is formed from a separate dielectric material selected from the group consisting of spin on polymer, . . . diamond like carbon dielectric materials, . . . and aerogel, **in claim 1**.

Hopper teaches, " . . . various carbon-containing low dielectric constant materials, typically having a dielectric constant of about 2.0 to about 3.8. . . . Typically such carbon-containing polymers are . . . Black Diamond®" (same as a diamond-like carbon dielectric material), (column 2, lines 47-55), and "the use of various carbon-containing dielectric material as gap filling layers" and "as ILDs (interlayer dielectrics) employing damascene processing, including single and dual damascene processing (column 5, lines 18-24), which reads on a first dielectric layer having a dielectric constant of less than 4.0 and is formed from a separate dielectric material selected from the group consisting of spin on polymer . . . , diamond-like carbon dielectric material, . . . and aerogel.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Yu by using a low dielectric material such as a diamond-like carbon as taught by Hopper for the purpose of reducing parasitic capacitances between conductive patterns.

Yu in view of Hopper differs in failing to explicitly teach an anisotropic etch method **in claim 1**

Avanzino teaches, "In the standard dual damascene process, the insulating layer is coated with a photoresist which is exposed through a first mask with an image pattern of the via openings and the pattern is anisotropically etched in the upper half of the insulating layer" (column 1, lines 37-41).

Hence it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Yu in view of Hopper by employing an anisotropically etch method as taught by Avanzino for the purpose of obtaining the controlling the shape of the contact openings.

3. Claims 8-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu ('883) in view Hopper ('901) and Avanzino ('238) in further in view of Chiang et al. (US 6,027,995).

Yu further teaches, "There may subsequently be formed within the aperture a patterned conductor layer within the second trench contiguous with a conductor stud layer within the via while employing a damascene method" (column 4, lines 51-55), which reads on forming within the aperture a contiguous patterned conductor interconnect and patterned conductor stud layer.

Yu in view Hopper and Avanzino differs in failing to teach the contiguous patterned conductor interconnect and patterned conductor stud layer is formed within the aperture while employing a chemical mechanical polish (CMP) planarizing method.
in claim 15

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Chiang teaches, "Once the via plugs are framed in an interconnect system, the via plugs are subjected to a process of chemical mechanical polishing (CMP)" (column 2, lines 10-14), which reads on, the contiguous patterned conductor interconnect and patterned conductor stud layer is formed within the aperture while employing a chemical mechanical polish (CMP) planarizing method

Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Yu in view of Hopper and Avanzino by employing cmp to form a patterned conductive stud within an aperture while employing a cmp method as taught by Chiang for the purpose of removing excess conductive material from the surface of the dielectric layer.

Response to Amendment

4. Applicant's arguments filed May 29, 2002 have been fully considered but they are not persuasive. Applicant traverses the 103 rejection of claims 1-7 and 8-15 as being unpatentable over Yu ('883) in view of Hopper ('901) and Avanzino ('238) and Yu ('883) in view of Hopper ('901) and Avanzino ('238) and further in view of Chiang ('995). Applicant argues the combination of Yu, Hopper, Hopper and Avanzino, and Chiang fails to teach every limitation of claims 1 and 8 and asserts the absence of disclosure of a method for forming a dual damascene aperture or a method for forming a dual damascene structure which employs a patterned first dielectric layer and a blanket second dielectric layer formed of a corresponding first dielectric material and second

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dielectric material each having a dielectric constant less than about 4.0, where the first dielectric material serves as an etch stop with respect to the second dielectric material.

Applicant argument is unpersuasive because Hopper is relied upon to teach low dielectric constant materials, typically having a dielectric constant of about 2.0 to about 3.8, which reads on a first dielectric layer having a dielectric constant of less than 4.0. Since Hopper's dielectric materials are the same as those of the claimed invention and are used in a method of forming an aperture as described by Yu, which is the same method as that of the claimed invention then using Hopper's dielectric materials would result wherein the patterned first dielectric layer provide an intrinsic etch stop.

Conclusion

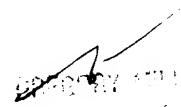
5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner can normally be reached on First Friday.

ltue
August 2, 2002


Lynette T. Umez-Eronini
Supervisory Patent Examiner
Art Unit 1765